TOUCH ACTIVATED AC, FULL WAVE, TWO-WIRE SWITCHES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of our copending application Ser. No. 580,056 filed Sept. 16, 1966 now abandoned for TOUCH RESPONSIVE MOMENTARY SWITCH CIRCUIT, of our copending application Ser. No. 614,477 filed Feb. 7, 1967 now abandoned for TOUCH ACTIVATED, AC, FULL WAVE, TWO-WIRE SWITCHES, and of our copending application Ser. No. 799,163 filed Feb. 14, 1969, now U.S. Pat. No. 3,530,312 for TOUCH RESPONSIVE MOMENTARY SWITCH CIRCUIT, and is an improvement on the invention disclosed in our copending application Ser. No. 572,092 filed Aug. 12, 1966, now U.S. Pat. No. 3,493,791 for TOUCH ACTIVATED SEMICONDUCTOR SWITCH.

BACKGROUND OF THE INVENTION

1. Field of the Invention

A touch responsive momentary switch employing in the activating leg of the switch circuit a normally high impedance which is discontinuously changeable from a high to a low impedance state upon a control terminal thereof being touched by a foreign body.

2. Description of the Prior Art

Insofar as the inventors are aware, there is no relevant prior art. The closest art of which knowledge is had is a switch circuit in which a glow discharge tube is located in the activating leg; but in such circuit the glow discharge tube is activated to its normal glow discharge region which is quite different from the circuit of the present invention.

Generally speaking, the instant invention relates to electronic device systems and, more particularly, to solid state electronic switches of the class which are responsive to the touch of a human operator, or the like, to change from an "OFF" condition to an "ON" condition.

The prior art contains numerous switch circuits, some of which are of the solid state type and are actuated in the manner described, i.e. by the touch of a foreign body such as a human finger; but, in general, these switching circuits are relatively complicated in circuitry and contain a considerable number of components so that they are not capable of being embodied in a physically and electronically compact form as is required in many present-day applications. Moreover, in prior art devices the touch operator, i.e. contact, serves as a passive element, being connected into the internal power of the system to create a triggering path. In other words, the touch element, in effect, forms a bridge, or the like, between a control element such as a gate and an internal source of power so that such element is not a true activator of the switching component within the device to directly initiate triggering, thereby, among other features, in accordance with the present invention avoiding any electrical danger to the user which could result if an overly high potential finds its way through a stray path or a defective component to the touch contact. Moreover, the prior art does not disclose full wave touch activated momentary and latching switches which have only two output terminals that enable the switches of the present invention to be easily connected into AC circuits which are to be controlled thereby.

Commutation in AC circuits is a natural phenomenon and obtaining circuit "HOLD-ON," in a touch activated switch circuit, which is contrary to the normal mode of operation, is one of the problems to be solved, in general, in connection with AC touch activated switches. The prior art discloses continual ON triggering in AC silicon controlled rectifier (SCR) circuits by synchronizing the triggering signal to the line frequency, or providing some other external synchronizing technique to not only trigger but continue the firing of the SCR past the AC zero crossing point in order to stay ON every cycle. However, these external synchronization design solutions are generally complicated, contain a considerable number of circuit components which increase the physical size and complexity of the overall touch activated switch circuit, and are generally too expensive for many of the applications in which the switch could be used.

SUMMARY OF THE INVENTION

The present invention provides an internal HOLD-ON technique to counter the commutating effects of the full wave rectifier AC source power from the bridge circuit portion of the switch circuit as it approaches zero. This technique and circuitry for accomplishing the same is shown and described in the aforementioned applications Ser. Nos. 580,056 and 799,163 wherein the turn ON or activation of the semiconductor switch is accomplished by controlled feeding of the power available at the anode gate of the SCR to the cathode gate thereof. This is achieved by inserting a very high impedance element in a circuit extending between the anode gate and the cathode gate which element is capable of a sudden change in impedance state to a lower impedance in response to the touch of a human finger, thus allowing power to be transferred to the cathode gate and the SCR to be turned ON in full wave operation.

In said applications Ser. Nos. 580,056 and 799,163 touch responsive, full wave, two-wire switch circuits including a pair of neon tubes in conjunction with a four-lead SCR are disclosed, which operate on this technique. The circuits of the present invention incorporate the same general internal HOLD-ON technique but represent a departure in that each switch circuit disclosed herein either is a simplified version of those disclosed in the last two mentioned applications, accomplishing the same functional objectives, or is a sophisticated form of those previously disclosed, but improving the versatility and/or reliability of the switch circuits. The circuits of the present invention also provide a touch activation circuit for feeding the power available at the anode of the semiconductor switch to the cathode gate to accomplish the switching and internal HOLD-ON technique.

The switches of the present invention contain very few circuit components, are relatively inexpensive in comparison with prior art switches, present no potential electrical danger to the user, this being achieved by isolating the user from the power flow path, can be housed in a single physically compact unit with a touch activating surface on one side of the unit, and provide only a pair, i.e. only two, terminals for connecting the switches into the circuits to be controlled.

Other advantages of the circuits of the invention will become apparent to a worker skilled in the art from the following specification.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings in which are shown various possible embodiments of the invention,

FIG. 1 is an electrical schematic diagram illustrating the theory of operation of the switch circuits of the present invention through the use of a single-pole single-throw switch that is an exemplificative electrical equivalent of the SCR that is actually employed in the operative circuits of the invention;

FIG. 2 is an electrical schematic diagram of a touch activated, AC full wave, two-wire momentary switch according to the present invention;

FIG. 3 is an electrical schematic diagram of a modified form of the switch circuit of FIG. 2;

FIG. 4 is an electrical schematic diagram of another modified circuit of the momentary switch circuit of FIG. 2;

FIG. 5 is an electrical schematic diagram of an AC full wave touch activated latching switch which is a modified form of the circuit of FIG. 3;

FIG. 6 is an electrical schematic diagram of a modified form of a full wave momentary switch according to FIG. 2; and

FIG. 7 is a plot showing the voltage-current characteristic curve of a neon glow discharge device. DESCRIPTION OF THE PREFERRED EMBODIMENTS